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Henbane—Healing Herb of Hercules and of Apollo

This poisonous drug, formerly available only from Europe, India and the Sudan but now produced also in the United States to the extent of 80,000 pounds annually, has been used therapeutically since ancient times and today has common use in modern medicine.

GEORGE M. HOCKING¹

Introduction

HENBANE is an official drug in the United States Pharmacopoeia where the name "Hyoscyamus" is used for both the English and Latin titles. It is described as consisting of the dried leaves with or without the flowering and/or fruiting tops of *Hyoscyamus niger* L. Likewise official in the U. S. Pharmacopoeia are the herbs prepared from the two other most important medicinal members of the family Solanaceae, namely, belladonna (*Atropa Belladonna* L.) and stramonium (*Datura Stramonium* L.). Of parallel value, therapeutically, they likewise have all been official in the U. S. Pharmacopoeia since this chief official compendium first appeared in its 1820 edition. The importance of Henbane is further witnessed by its being official in nearly if not all present-day national pharmacopoeias, approximately 20 in number.

Besides the leaves, optionally with tops, other parts of the plant have been used, either officially or unofficially, *viz.*, herb, seeds, fruit, root, stalk (Dioscorides), *etc.*, not to mention the expressed juice and the smoke.

Geographical Origin and Distribution

The species *Hyoscyamus niger* is believed to have been originally a denizen of Eurasia, and is now distributed

throughout Europe from Portugal and Greece, on the south, to Norway and Finland, on the north. It is found also in the Caucasus, Iran, throughout Asia Minor, in northern India and even in Siberia. The plant has been naturalized in North America, at least since about 1670, and now grows wild in the eastern, northern and western United States and in parts of Canada. It occurs chiefly in waste places, such as near buildings, on roadsides, in graveyards, old gardens, and in areas covered with rubbish from ruined buildings. In habitat, therefore, it considerably resembles its relative, stramonium, except for its more northerly distribution. The plant is now cultivated for medicinal use in a number of countries, including our own.

Common Names

As one might reasonably expect from its importance, the species under discussion has acquired many common or vernacular names. The most important names applied to the plant and the derived drug are in English: Henbane, so-called, maybe, because the seeds are said to kill fowl; Henbain; Hyoscyamus Leaves; Hyoscyamous; Henbane Leaves; Common Henbane; Black Henbane; Stinking Nightshade; Foetid, or Fetid, Nightshade; Insane Root; Poison Tobacco; Soldier's Herb; Soldier's Tree; Hogbean, because the plant is said to be eaten by hogs; Hog's Bean; Hogbane (?); Hen-bell. Older English words almost never heard now include belene;

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chenil(l)e, apparently stolen from the French; brosewort (?); hanebane; hainbane; henkam; hennebane; hennebone; hennibone and Stinking Roger.

In Latin the species has been variously known as *Hyoscyami Folium*, a title used by the International Pharmacopeia; *Hyosciamus*; *Herba Apollinaris* or *Apollo's Herb*²; *Symphoniaca Herba*, on account of the resemblance of the flowering and fruiting axis to the musical instrument of that era known as the symphonia; and *Jusquiamus*.

In France *H. niger* has been called la Jusquame from the Latin "*Jusquiamus*"; *Jusquame Noire*; *Potelée*; *Herbe-des-chevaux*; *Hanebane*; *Hanibane*; *Hannebanne* (Gaston Bonnier), and so on. In German the drug is (Schwarzes) *Bilsenkraut*; *Bilsen*; *Dullkraut*; etc. In Dutch the species is known as *Bilsenkruid*, etc.; in Norwegian, *Bulmeurt*; in Swedish, *Bolmört*. The common Spanish name is *Beleño* (*Hojas*); the Portuguese, *Meimendro* (*Folhas*); the Italian, *Giusquiamo* (*Fogliass*).

Description of Plant

Hyoscyamus niger occurs in two distinct forms. One of them is the annual plant, of interest as having been specifically excluded from some pharmacopoeias (e.g., U.S.P. 1880, 1890, and the eighth revision). The plant seldom grows higher than two feet, is slender in habit and little if at all branched. Its various parts develop on a smaller scale than in the biennial form. The leaves are less distinctly toothed and the corollas show little or no purplish veining. This is the form of the plant which was cultivated by the "herbalists" of a bygone generation.

The biennial form appears to be much the commoner. For instance, Stewart found that when seed of wild-growing Montana plants was sown, the biennial

forms were produced.³ During the first year of growth the plant develops a large whitish, fleshy, tapering, branched root, somewhat resembling that of a parsnip or small horse-radish, crowned by a radical rosette of large leaves, a foot or more long, with very long petioles and coarsely toothed, lobed or deeply cut blades. No aerial stem is produced. During the second year the plant throws up an erect, thick, coarse and widely branched stem, two and a half to four or even five feet tall, which bears flowers in long, secund, leafy, spike-like groupings. The flowers in this form have prominent purple vein markings on the corolla. Fruits are formed within the permanent calyx, and as these mature, the entire plant dies. At this stage the root becomes spongy and then hollow, and the radical leaves disappear, while those on the stem are found to be quite broad with relatively short petioles or even sessile near the top of the stem.

Wild growing plants near Bearmouth, Montana, were found by Stewart to have, instead of one flower stalk, as customary, several stalks (up to twelve) growing from a single root-crown. It was suggested that this was due to cropping of the first year's growth by sheep. The plants ranged from two to five feet in height, the taller growing in a shady ravine, the smaller in the sunlight on a hill-top. Undoubtedly the rich fertilized soil of the sheep corral, in which the plants grew, accounted in part for the luxuriant growth. No infestation or plant disease was noted, although such have been reported for plants growing farther east in Montana. Catnip, mullein and horehound were growing alongside. The plant thrives well in Montana to over 7,000 feet elevation, and in India it has been reported from altitudes of 8,000 to 11,000 feet.

³ These and other data in this article relating to Montana Henbane, unless otherwise stated, were gleaned from the unpublished M.S. Thesis of George W. Stewart of the State University of Montana, 1934, kindly loaned to the author.

² Apollo of the Greeks = Hercules of the Romans.

Cultivation

Some people who have cultivated a variety of medicinal plants state that henbane is one of the most difficult of its family to rear successfully, *i.e.*, to produce a drug meeting official requirements.

Experiments in cultivation have been carried out in the Drug Garden of the School of Pharmacy at the State University of Montana (Missoula). The seed used was collected from a plot of wild-growing plants near Bearmouth, about 40 miles from Missoula. Seed was gathered the last of August and sown on April 15 of the following year (*ca.* 1933). Before planting, it was treated with 5% sulfuric acid for 20 minutes, then washed with water and dusted with lime to neutralize and provide calcium for the seedlings. Small shoots developed in about three weeks. The plants were thinned out several times during the season. Growth continued until the summer, when an arrest of growth occurred with the plants one-half to one foot high. The following spring the plants sent up flowering stalks which bore blossoms in July. These biennial plants appeared free from disease or infestation, although untreated by spraying, *etc.*

The transplanting of henbane seedlings from a greenhouse or cold-frame to the outdoor area has not been very successful, for most plants do not survive the shock of moving, and those that do are stunted in growth. This is said to be caused by injury to the tap root. Better results are achieved if plants are allowed to attain fair size before being moved.

Because of this obstacle to large-scale propagation, the Wisconsin Pharmaceutical Experiment Station at Madison years ago undertook experiments to determine whether the seed might not be sown directly in the fields, as is done with stramonium. Biennial seed was

accordingly sown in early December, 1916, and began to come up about May 10, 1917, while some of the same seed sown on April 21 came up on May 16. Besides taking only one week more to emerge from the soil, the spring-sown seed gave a more uniform stand.

In growing henbane it is best to select a level area, as free as possible from weeds. A well drained fertile sandy loam or silt loam is considered best. One pound of seed is enough per acre and should be sown in rows two feet apart. If kept dry, henbane seed remains viable for several years, a fact which accounts for certain reported vagaries of growth. It is best to test germination of the seed before sowing. The best seed is that which has been specially collected for planting purposes. Pre-treatment of seed with concentrated mineral acid was reported to result in germination in about 20 days rather than the usual 30.

Sowing may be done by mixing the seed with sand and dropping it into shallow holes. Better still, a small seeder will give more uniformity. The seeding should be at such a concentration that one viable seed is laid every four inches along the row, and the seeds must not be covered by more than about one-quarter inch of soil.

Cultivation may be carried on before the young plants appear, if the rows can be distinguished or have been properly marked. Later on, regular weeding should be practised, and if necessary the plants ought to be thinned out so as to leave them about four inches apart.

Harvesting of leaves and flowering tops is carried out when the plants are in full bloom (June to August) and before the first frost. Drying is best performed in a drying house, where the herbage may be spread in thin layers on floor, trays, *etc.* Drying is hastened and color and quality improved by using a small amount of heat and air currents.

A yield of 600 pounds of Henbane per

acre may normally be expected. Almost twice as large a crop per acre may be obtained from the first- as from the second-year plants.

Infestations and Diseases

From the literature it appears that the Colorado potato beetle is henbane's worst enemy; it has been said to prefer henbane to all other plants. If the plants are not to be entirely destroyed by this pest, they must be sprayed with an insecticide. In the past, lead arsenate has been mostly used. Paris Green was found destructive to the plant, and sulfur soon loses its effect on the insects which prey on it. Two sprayings of 1 to 1,000 suspension of lead arsenate during the life-time of the plant are said to be adequate. Among the fungi reported as attacking *Hyoscyamus* are *Peronospora* (Phycomycetes) and the mildew *Erysiphe* (Ascomycetes).

Commerce

Before World War II most Henbane drug imported into the United States came from Europe, chiefly Hungary, Belgium, France, the Soviet Union, Germany and Italy. During more recent times exports have come chiefly from India, the Sudan, the United Kingdom, the Soviet Union and elsewhere, but the largest bulk has been domestically produced in the continental United States. At present the U. S. exports only a few thousand pounds of the approximately 80,000 produced here annually.

Montana is or recently has been the chief producing area for domestic Henbane, although the plant grows wild commonly in sections of the other north-western States, *i.e.*, Idaho, Washington and Oregon. The plant is said to have first been observed growing in Montana at Big Timber, in the year 1883. The plant grew from a pile of dirt thrown from the basement of an hotel under construction. It is thought that a workman

engaged in the labor dropped smoking tobacco admixed with the seed, since it is known that henbane seed has sometimes been mixed with tobacco to bestow a narcotic effect.

The species was subsequently collected in 1900 at Billings, Big Timber, Bozeman and elsewhere in Montana, and was spread to other parts of the State by admixture with hay, it is thought. Thus, the patch at Bearmouth is believed to have come from seed of plants mixed in hay for feeding horses used by convict labor when the Missoula-Deer Lodge road was built.

Henbane has sometime been marketed in grades representing stages of growth: (a) "Annual" or "seedling"; (b) "First Biennial", for leaves or herb of the biennial plant in its first year of growth; (c) "Second Biennial", for leaves of second year. The last item is scarce and high priced. In opposition to earlier opinion, first-year leaves have an alkaloid content similar to that of second-year leaves and are now considered equally as useful medicinally. However, they contain more acid-insoluble ash (sand, dust, *etc.*), no doubt because they are entirely basal leaves and not partly basal, partly stalk-leaves.

Description of Drug

The crude drug consists of much wrinkled, matted and broken leaves mingled with many stems and flowering and fruiting tops. The leaves are ovate to ovate-lanceolate, up to 26 cm. long and 10 cm. wide, not evenly divided by the mid-rib, the lower leaves petiolate, with petioles up to one-third the length of the blade, and the upper leaves stalk-less. The tips of the leaves are acute, the margins irregularly dentate (toothed) or pinnatifid (deeply lobed), with acute deltoid lobes. The upper surface of the leaf is darker than the lower. The leaf color is a shade picturesquely described by Parkinson

(1640) as a "darke or evill grayish greene colour". The same Apothecary and Botanist to the King gave the odor of the entire plant as a "heavie evill soporiferous smell somewhat offensive". Others have called it "dank", "benumbing", "narcotic", "noisome", "horrid", "heady", peculiar, strong, unpleasant, rank, distinctive, heavy, fetid, and so on. The aroma of Henbane has been compared to that of fresh tobacco, black currant leaves, and musk. The taste of the crude drug is bitter and acrid.

Henbane flowers are nearly sessile, with an unequally five-toothed, urn-shaped, hairy calyx, and a yellowish, campanulate, slightly zygomorphic corolla, with purplish veins. The corolla ends in five unequal obtuse lobes, and five stamens are inserted in its tube.

The fruit consists of a two-chambered pyxis (urn-shaped type of capsule which dehisces or opens by separation of a lid-like top) enclosed in the persistent calyx. When found, the seeds are black (hence the specific name of the plant) to dark gray, round-oval, numerous, tiny, unequal and hard.

The stems are two to seven mm. in diameter, somewhat compressed or cylindrical, longitudinally wrinkled and hairy.

The powdered drug is dull grayish-green to dark green. When examined under the microscope, it reveals calcium oxalate crystals in the form of monoclinic prisms, as twin crystals and as rosette aggregates (the latter not common). Non-glandular hairs are found, ranging from one to ten cells in length—these are often broken up in the powdered drug. Glandular hairs with a one- to four-celled stalk and a unicellular or multicellular secreting head also occur. Newcomb observed that very large branching non-glandular hairs, which had not previously been described for this plant, presumably because they are of relatively soft structure, are found on green plants and apparently soon dis-

appear when the plant is dried and handled.

Also observable microscopically are epidermis fragments with broad elliptical stomates having three or four neighboring cells, one of which is smaller than the others; fragments of tracheae with pores, reticulations and spiral markings; bast fibers; and pollen grains which are nearly smooth and bear three furrows.

Chemical Constituents

Henbane contains several important constituents, the two most important being the alkaloids hyoscyamine (crystalline) and scopolamine or hyoscyne (amorphous). Minor other alkaloids, e.g., scopoline and tropine, are present in traces.

Scopolamine was first isolated from the herb in 1833, and was obtained first from the seeds in 1871. It is a syrupy compound in the free state, but a crystalline solid in the form of the common salts. Scopolamine hydrobromide is official in the U. S. Pharmacopoeia and is used considerably in medicine, both by mouth and hypodermically. Henbane is not, however, the chief source, since this alkaloid is obtained mostly from *Datura* species, a related group in the Solanaceae.

The other alkaloid, hyoscyamine, is not now commonly used in medicine and is no longer official in the national compendia which serve as standards for American drug products.

Other components of Henbane which have been isolated are hyoscyperin (a glycoside), choline, mucilage, albumen, chlorophyll and potassium nitrate. The last compound (salt peter) is presumed to cause the characteristic sparkling effect seen when the dried leaf is ignited. The seed contains much fatty oil (about 25%) and also a little volatile oil.

Analyses of Domestic Drug

According to U. S. Pharmacopoeia XIII, the drug Henbane must contain

not less than 0.040% of the alkaloids characteristic of the plant. This is a lower requirement than that in earlier pharmacopoeias (*e.g.*, U.S.P. IX, X, where not less than 0.065% alkaloids was required, or U.S.P. VIII set 0.080% as a minimum).

Analyses of Montana Henbane, the chief domestic type, show that most lots are comfortably above the minimum required strength, as at present defined. Thus, one crude-drug concern⁴ has furnished the following values for commercial batches of the Montana product:

<i>Number of lots</i>	<i>Test (% total alkaloids)</i>
1	0.042
4	0.054
7	0.060
3	0.061
5	0.065
4	0.073
1	0.078
1	0.090
<hr/>	
Total 26	Average 0.0633 for all lots

From this it appears that 15 or more than half of the lots were below the former official strength, while the average assay of all lots was less than the former required figure. On the other hand, all lots meet the present minimum assay requirement, and one of them is more than twice as high as the needed assay.

Stewart found that the U.S.P. X assay method was unsatisfactory in assaying the Montana drug with which he worked⁵, due to the formation of very stubborn emulsions in "shaking out" the alkaloids. By this method the Montana drug assayed only 0.005% (aver-

⁴ S. B. Penick & Company, New York; data furnished through the courtesy of Dr. Thomas Lewis, Vice President and Technical Director.

⁵ Material was collected from wild-growing plants close to the Butte-Missoula highway near Bearmouth. The leaves and flowering tops were collected June 28, 1933, dried and ground to a #40 powder.

age), while commercial imported Henbane ran 0.0867% or about 17 times as high. To help remedy this, the drugs were first defatted with petroleum ether. Assays then ran higher (0.030% average for domestic; 0.078% in commercial drug).

In order to partially simulate conditions undergone by the commercial drug, the Montana material was heated at 95° for two weeks to drive off volatile matter. After this treatment the drug was of much the same color as imported material and had lost much of its offensive odor. In conducting assays with this, no difficulty was had with intractable emulsions, as before. Material so treated averaged 0.044% alkaloids (imported drug 0.071%).

Finally Stewart tried the method of C. M. Caines (1929), which seemed an improvement over other methods, and this gave results indicating a Montana product almost meeting the then current official standards, since the average of determinations was 0.057% (imported drug 0.081%).

Stewart also made other chemical studies on the Montana Henbane (same material as that used for alkaloidal studies). He obtained the following values:

Loss on air drying (25° C.)	88.18%
Total volatile matter ^a	10.89% (aver.)
Total ash	19.25% (aver.)
Acid-insoluble ash	
(not more than 12% allowed, U.S.P. X-XIII)	2.73% (aver.)

Successive extractions by Soxhlet method:

Petroleum			
ether	5.67%	(average imported,	3.35%)
Ethyl			
ether	5.10%	" "	2.49%)
Alcohol	23.91%	" "	16.87%)
Dist.			
water	20.68%	" "	20.99%)

Other findings were:

Crude		
fiber	6.11%	" "
Total nitrogen (in leaves)	4.24%	(average)

The seeds of *Montana* henbane were also studied by Stewart. He reported in his Thesis the following values from chemical tests carried out on the seeds ground to a fine meal (all figures are averages) :

Volatile matter (100° C.) ⁶	10.39%	
Total ash	2.87%	
Acid-insoluble ash	0.41%	
Successive extractions by Soxhlet method:		
Petroleum ether	32.63%	The bulk of this extractive (non-volatile) is of course the fatty oil.
Volatile portion	1.95%	
(of crude)		
Ethyl ether	31.14%	
Volatile portion	3.42%	(of crude)
(of crude)		
Alcohol	24.61%	
Distilled water	6.60%	
Crude fiber	25.33%	
Total alkaloids	0.093%	(after defatting seeds)
“ “	0.130%	(by Caines' method)

The fatty oil was extracted from the seeds with petroleum ether, then the solvent evaporated and the oil filtered through cotton. The fixed oil constituted about 25% of the seeds (W/W). It was amber-colored with a bland innocuous taste and very little odor. The following constants were reported by Stewart :

			<i>Values of Bureš and Kracík (cold ex- traction)</i>
Spec. Gravity (25° C.)	0.9183		0.9120-4 (d15°)
Refract. Index (25° C.)	1.4739	
Saponification No.	191.72	(average)	187.8
Iodine Absorption No.	82.07	(average)	135.7

The figures for the *Montana* seed oil and that of Bureš and Kracík for plants grown in Czechoslovakia are far from

⁶ Determined by heating in oven at 100° C. until of constant weight.

concordant, but may be partly explained by the differing habitats and latitudes.

Derivatives and Preparations

It is typical of the human being to attempt to improve on nature, and in the field of medicine we find no exception. Instead of administering the whole leaf of henbane, or its powder, it has been customary to give either the so-called galenical preparations, such as tinctures, extracts, *etc.*, or the alkaloids. From an historical standpoint the preparations are of much greater importance, and the elegance and imaginative titles which have distinguished many of them are quite interesting. A mere listing of the titles, in some cases translated into English, is very revealing of the human ingenuity displayed in the administration of this one drug :

<i>Modern or Current :</i>	Syrup
Tinctures	Narcotic Boli (large pills)
Fluidextracts	Pills
Extracts (both semi-solid and powdered)	Pills of Extract
Fomentations	Narcotic (or Sedative) Pills
Compound Oils (Infused Oils, <i>etc.</i>)	Antichoreic Pills (for St. Vitus' Dance)
Abstracts	Anti-hysteric Pills
<i>etc.</i>	Anodyne Pills
<i>Formerly popular (as described in the Universal Pharmacopoeia, published at Weimar in 1845) :</i>	Anodyne and Resolvent Liniment
Anticephalagic	Pomade
Paste (for frontal headache)	Antispasmodic Elixir
Anodyne Cataplasm	Collyrium (Eye Wash)
Electuary for Hemoptysis (spitting of blood)	Sedative Narcotic
Conserve (made with white sugar !!)	Hauftus (Draught)
Oil of the Seed	Breast Draught
"Paregoric Oil"	Expectorant
Hemorrhoidal Ointment	Draught
Juice	Enema
Seed Extract	Infusion
Fecula (a starchy preparation)	Sedative Emulsion
	Anti-odontalgic Collyrium (Mouth wash for toothache)
	Narcotic Cataplasm
	Alcoholic Extract
	Essence

Tincture of Seeds	Anodyne Ointment
Ethereal Tincture	Tranquil Balsam
Green Oil	Ear Oil
Ointment	Sedative Liniment
Plaster	Compound Poplar
Unguen tum ad Ambusta seu Combustiones (Ointment for burns or burnings)	Ointment
	Hemorrhoidal
	Lotion
	<i>Etc.</i>

Uses in Medicine

The physiological action of Henbane is similar to that of Belladonna, Stramonium, Scopolia and similar drugs of the Solanaceae. While less powerful than they, Henbane is relatively more sedative and hypnotic and causes little or no constipation and other unwanted by-effects.

Ancient Uses. Henbane has been employed as a medicine from very early times. Baron Hammer-Purgstall actually believed "bendj" (Arabic for Henbane) was the *Nepenthe* of Homer. White Henbane was one of the "simples" used by Hippocrates (5th Cent., B.C.). This plant is quite similar to our Henbane in medicinal effects.

Dioscorides (A.D. ca. 60) called the plant "hyoscyamos" (literally "hog's bean"), but he also mentions "dioskyamos" (bean of the gods) as an out-moded name, possibly so-called from the usage of the drug in the temple "mysteries" or religious rites. In his works Dioscorides described three species—black, white and yellow. Of these he particularly commended the "white" as being the least dangerous. (As a matter of fact, it closely parallels black Henbane medicinally, although rather weaker in action). Dioscorides recommended the root with vinegar as a mouth-wash for toothache, and 17 or 18 centuries later we find still prescribed an Anti-odontalgic Mouthwash made from a mixture of henbane and plantain leaves with violet and red rose flowers, poppy heads and sage leaves in water, properly processed. Not as useful perhaps as the

modern novocain or even clove oil, yet this preparation doubtless eased the pain of many a case of odontalgia. Another application of Henbane for the same purpose during the past few centuries has been that of burning the seeds and funneling the fumes into dental cavities in an effort to expel the "tiny worms" believed to cause the distress resulting from caries.

Pliny (fl. 60 A.D.) recognized the psychogenic qualities of the drug when he wrote:

"Henbane is of the nature of wine, and therefore offensive to the understanding, and troubles the head. . . . [It ought] to be used with great heed and discretion. For this is certainly known, that, if one take of it in drink more than four leaves, it will put him beside himself".⁷

An early contraceptive was made by mashing the seeds into paste with mare's milk and tying the paste in a piece of wild bull's skin.

In the Middle Ages Henbane was used legally as an anesthetic (with opium, mandrake, hemlock juice, aconite, datura, etc.) in the form of a "soporific sponge" and of the "pomander" (sleeping apple), acting through inhalation; it was also employed illegally as a sleeping potion, much as "knock-out drops" are used in our time. Gui de Chauliac of the 14th Century thus described the use of a narcotic inhalation:

I'll imitate the pities of old surgeons
To this last limb, who, ere they show their cut,
Cast one asleep, then cut the diseased part.

The medicinal popularity of Henbane dropped after the Middle Ages along with that of Belladonna, until by the 1700's it fell into disuse and was omitted from such compendia as the London Pharmacopoeias of 1746 and 1788, being returned only in the edition of 1809. Henbane was reintroduced into occidental medicine chiefly as the result of original labors by Professor Baron

⁷ Holland's translation (1601), revised.

Stoerck of Wien, who in 1762 carried out an investigation of the remedial value of Henbane, Stramonium and Aconite.

The Arabians, too, were familiar with the medicinal value of Henbane, as may be gathered in part from the following extract from that great anonymous classic, "The Thousand and One Nights":

"Presently he filled a cresset⁸ with firewood on which he strewed powdered Henbane, and lighting it, went round about the tent with it till

(digestion aider), sedative (nerve quietener) and antispasmodic (spasm antidote). Thus, Henbane has been used as a sedative in acute and chronic mania, epilepsy, hysteria, "hypochondriac monomania," delusional insanity ("madness")⁹, melancholia, nervous or irritable cough, tremor in paralysis, febris nervosa (where fever arises from purely nervous disturbances), insomnia with hallucinations, delirium tremens, priapism, *etc.* It is used for its anodyne properties in angina pectoris, arthritis,



FIGS. 1-4. Henbane growing wild in a sheep corral and elsewhere near Bearmouth, Montana. (Courtesy G. W. Stewart.)

the smoke entered the nostrils of the guards, and they all fell asleep, drowned by the drug".

Modern Uses. During the past century and a half Henbane has found many uses in western medicine, uses depending on its value as an anodyne (pain reliever), hypnotic (sleep promoter), narcotic, mydriatic (eye pupil enlarger), mild laxative, carminative

⁸ A holder for torches and other burning objects.

rheumatism, locomotor ataxia, colica pictonum (colic of lead poisoning, lead colic, or painter's colic), other colics, podagra (or gout), neuralgia, gastralgia (stomach ache), cephalgia (headache), teething of babies¹⁰, *etc.* As an anti-

⁹ Strange to say, Henbane is also said to cause insanity.

¹⁰ Formerly, pieces of the root were strung around the neck of the baby to form the so-called "anodyne necklace".

spasmodic it was and sometimes still is used in asthma, chorea (St. Vitus' dance), tetanus, constipation, whooping cough, phthysical coughs, croup, *etc.*

Hyoseyamus is sometimes used locally for applying to painful swellings, irritable ulcers, tumors, severe chordee, orchitis, *etc.*

A most important modern usage of Henbane and other solanaceous drugs is as a corrective for griping medicines, such as strong purgatives. It serves as an antidote in poisoning by mercury and other agents, and is occasionally used in treating the morphine habit.

Henbane is sometimes used also as an hypnotic, *etc.*, where opium derivatives cannot or are best not used, as for children.

Among the so-called "mydriatic" or "solanaceous" alkaloidal drugs, Henbane is ranked in importance next after Belladonna. The average dose is 0.2 Gram.

Non-medicinal uses include its employment for ages by professional poisoners. And finally, the leaves of the plant are said to repel mice.

Poisoning

The toxic properties of white Henbane have been recognized since long before the time of Christ. Poisoning comes about generally from the ingestion of doses larger than medicinal, and as a rule are seen where an overdose of medicine is taken, or where a part of the plant is accidentally consumed, as by children. Most recent poisonings described have been from one of the alkaloids.

Poisoning begins with the development of mouth dryness, burning throat, pupil dilatation, visual disturbances, giddiness, nausea and hallucinations. If remedial measures are not taken and the dose is sufficiently large, more serious symptoms ensue, such as difficult respi-

ration, delirium, feeble quick pulse, coma, convulsions and finally death by paralysis of respiration. Fairly characteristic is the reddening of the skin of face and neck, somewhat reminiscent of that in scarlet fever, but in later stages of poisoning the skin becomes cold and clammy, although the rash may persist even after death. Most characteristic of all, at least for the solanaceous group, is the persisting enlargement of the pupil of the eye. This mydriatic effect commonly continues for several hours after death.

Treatment is best conducted by washing out the stomach with a stomach-pump, using tannic acid in the wash water. As antidotes, morphine or caffeine may be used with care.

Adulteration

Henbane is sometimes adulterated, although less often than formerly. *Hyoscyamus muticus* L. (Egyptian or Cyprus Henbane) leaves and tops have sometimes been seen admixed with the true Henbane. This is a particularly dangerous adulterant, because this plant is very much richer in alkaloid than our Henbane. Also, other unofficial Henbanes have been used at times to adulterate or sophisticate true Henbane. Also so used have been Stramonium, Belladonna, Mullen and Digitalis. Adulteration is best detected by means of the microscope, since when dried and crumpled, these various leaves have considerable similarity to the unaided eye. Thus, microscopically, Henbane is very readily distinguished from both Belladonna and Stramonium by its much greater coverage of the leaf by trichomes.

Other Hyoscyamus Species

Approximately 20 species of *Hyoscyamus* are recognized. One species, *Hyoscyamus albus*, has already received passing notice. It was used by the ancients for catarrh, cough, *etc.*, and the

natives of southern Europe, where it grows, still sometimes use the plant in much the same manner as we do our medicinal Henbane. They also grow it as an ornamental in flower gardens, and additionally *H. aureus* L., which also is occasionally used as a drug. The root and herb of *H. physaloides* L. was once used in Siberia in place of opium as a

medium of exchange. *H. muticus*, already mentioned as an occasional adulterant of Henbane, is imported into this country in considerable quantities for use in alkaloid manufacture, as is well known. The alkaloid content is roughly 25 times as great as that of "Henbane Niger", as true Henbane is sometimes referred to in commerce.

Utilization Abstracts

Bamboo Pulp. "The future for white paper made of bamboo is bright. Runs made a few months ago were so successful that one concern is contemplating cultivation of bamboo in Texas for commercial use. Only a few of the 123 varieties now being grown in a United States Experimental Station near Savannah, Georgia, have been tested, but further research is now being carried on". (*Pulp and Paper Bulletin*, as reported in *Chemurgic Digest* 5(13): 235. 1946).

Cork Oak in Maryland. Through the cooperation of the Crown Cork and Seal Company of Baltimore and the Maryland Department of State Forests and Parks, experimental plantings of cork oak, *Quercus Suber*, have been made in Maryland. It has been found that the southern counties and the Eastern Shore of the State are suitable for growth of this tree which is native to the western shores of the Mediterranean. It is hoped that this may indicate possible future commercial production of cork in the State, not only as a forest crop but also on farms where the acorns would be of value as hog food.

"For normal peacetime manufacturing requirements in the United States about 160,000 tons of cork are imported annually. Sixty percent of the cork brought to this country is used in the manufacture of cardboard insulation. Other uses of cork include: floats for gauges and fishing nets, life jackets, shoe inner soles, printing press blankets, closure liners, ring buoys, gaskets of many kinds for

automobiles, tractors, trucks, household appliances and industrial equipment, linoleum, cork tile, sporting goods and novelties". (*G. B. Cooke, Chemurgic Digest*, 5(10): 187. 1946).

Charcoal. Charcoal is produced either as the residue from wood distillation operations in large retorts, or by incompletely burning wood under an earth blanket to carbon without any consideration being given to the volatile products driven off. In the north-eastern States there are four main uses of charcoal:

First, in shade-tobacco curing sheds. About 7,500 tons are annually used for this purpose in the Connecticut Valley, some of it in the form of briquets obtained, when available, from the Ford Motor Company in Michigan. These briquets are molded from powdered charcoal with starch or other material as a binder.

Second, as fuel for home cooking by the foreign-born population.

Third, in industrial operations, chiefly brass and other metal industries, where charcoal possesses qualities particularly valuable to the processes.

Fourth, as a purifying agent. Pulverized charcoal, treated to drive off the hydrocarbons, is converted into "activated charcoal" which possesses absorptive qualities as a refining and purifying agent. Water companies use it to remove tastes and odors from drinking water. (*E. L. Heermance, Chemurgic Digest* 5(10): 188. 1946).